NGST Systems Engineering Report

Thermal Subsystem 07

Title: **OTA Temperature Sensitivity to Sunshield Layer to Layer Thermal Conductance**	
Date: 5/4/98	Number: THSER07
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References:	

Description

A parametric thermal analysis was conducted to examine the effect on the primary mirror's average temperature of various amount of thermal conduction among the sunshield layers. The conductance values would occur in the form of shorts due to shield layer touching or conductivity through various deployment and support hardware. All baseline thermal modeling of the sunshield ignores conduction due to such hardware or layer physical interaction. Although the shield will be designed to prevent thermal shorts via touching, there will probably be conductive heat transfer via the sunshield support system. Since a detailed mechanical design of the shield does not yet exist, a thermal analysis was performed to characterize the shield thermal performance sensitivity to thermal shorting. The shield thermal performance is quantified by examining the primary mirror's average temperature.

The analysis was performed by introducing layer to layer conductances at each sun shield layers thermal node. The amount of conductance was parameterized by considering the amount of surface area each thermal node represented. The appropriate conductance per unit are was then introduced and varied to gage the effect on the primary mirror's temperature. The amount of conductance was varied up to 1.0 W/K/m^2

Results Summary

Figure 1 illustrates the primary mirror's average temperature response to layer to layer shield conductance. The results indicate a rapid rise in mirror temperature when the conductance reaches more than 0.01 W/K/m^2. The analysis assumes that the conduction is spread uniformly over the sunshield's entire area, where realistically the thermal shorts will occur at discreet points. The primary mirror's response to point conduction will probably be less on the outskirts of the shade but higher in the middle where the view factors to the shade are higher. Based on these results the mechanical design of the shield should attempt to minimize thermal shorts as much as possible, and the resulting cumulative value should not exceed more that 0.01 W/K/m^2. At this value or at higher values, conductive shorts combined with other degrading parameters on the sunshield's thermal performance could raise the primary mirror's temperature to unacceptable levels.

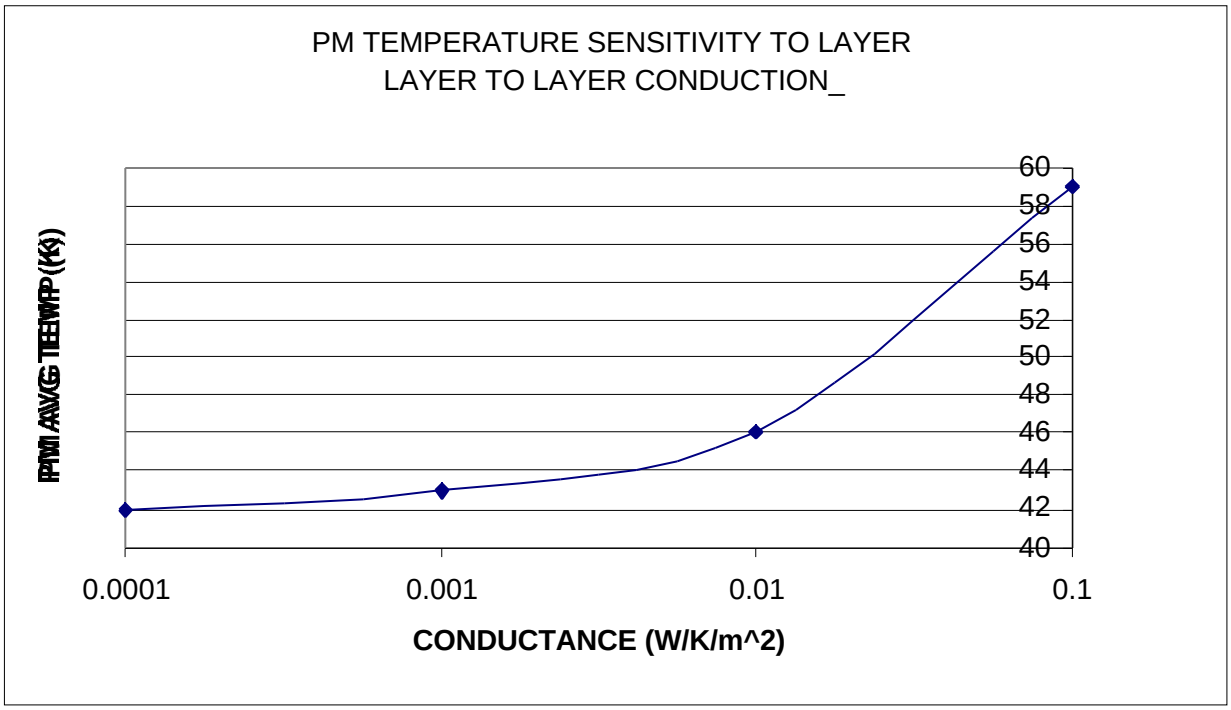
PM TEMPERATURE SENSITIVITY TO LAYER
LAYER TO LAYER CONDUCTION_
PM AVG TEMP (K)
60
58
56
54
52
50
48
46
44
42
40
0.0001
0.001
0.01
0.1
CONDUCTANCE (W/K/m^2)

Figure 1